THERMO ELECTRIC

File #

1923

New 12-10-81

Instruction Manual

MiniMite and MultiMite

Models 31101, 31107
31111, 31112
31113

Printed in U.S.A.

TE-8009

TABLE OF CONTENTS

SECTION	SUBJECT	PAGE
	WARRANTY	
1-0	DESCRIPTION	1
1-1	Introduction	1
1-2	Application	1
1-3	General Description	1
1-4	Specifications	2
1-5	Principles of Operation	2
2-0	INSTALLATION	6
2-1	Unpacking	6
2-2	Location	6
2-3	Mounting	6
3-0	OPERATING INSTRUCTIONS	7
3-1	Operating Controls	7
3-2	Operating Procedures	8
3-3	Measuring Temperature Using a Thermocouple	8
3-4	Checking Potentiometer-Type Instruments	10
3-5	Calibrating Millivoltmeter-Type Instruments	12
4-0	MAINTENANCE	15
4-1	Preventive	15
4-2	Periodic	15
5-0	TROUBLESHOOTING	15
5-1	General	15
5-2	Troubleshooting Guide	15
5-3	Replacement Parts	16
6-0	CALIBRATION	17
6-1	Adjustments	17
6-2	Method	18

SECTION	SUBJECT
7-0	APPENDIX
7-1	Photographs, Parts Identification Front View, MiniMite with case Removed Front View, MultiMite
7-2	Drawings Schematic Diagram, MiniMite Schematic Diagram, MiniMite with C.V.S. Schematic Diagram, MultiMite
8-0	ADDENDUM
8-1	Installation in Panel
8-2	Constant Voltage Supply
8-3	Shipping Instructions
8-4	Drawings Installation Drawing, MiniMite in Flanged Case Schematic Diagram, Constant Voltage Supply

WARRANTY STATEMENT

Thermo Electric Co., Inc. warrants each of its instruments to be free from all defects in material and workmanship for a period of one year, commencing on the date of shipment from Thermo Electric.

The liability of the seller is limited to the repair or the replacement of the product only if failure occurs during the warranty period and factory inspection shows no external affects or customer repair altered the functioning of the instrument.

The instrument is to be returned to Thermo Electric or the nearest Thermo Electric authorized service center, freight prepaid, via the most economical service transportation methods after authorization by Thermo Electric. All charges for handling, reinstalling and miscellaneous expenses incurred will be the responsibility of the buyer. When factory examination shows the returned instrument to be within the above warranty period, the equipment will be repaired or replaced, at the seller's option, at no charge to the buyer. This warranty shall be rendered null and void when, in the judgement of qualified Thermo Electric personnel, the equipment has been subject to abnormal or abusive use of lack of proper care or maintenance by the buyer, or when it has been determined that environmental conditions have exceeded those specified by Thermo Electric.

Any alteration or repair of the goods by the buyer or any party not authorized by Thermo Electric without our specific consent, in writing, shall automatically terminate our warranty obligation.

This warranty on instruments manufactured and/or sold by Thermo Electric, or, on any service provided by us, is expressly in lieu of all other warranties, express or implied. No warranty is made of MERCHANTABILITY or fitness for any particular purpose.

No agent is authorized to assume any liability for it or to make any written or oral warranties or obligations beyond those set forth herein unless endorsed in writing and signed by an officer of Thermo Electric.

1-0 DESCRIPTION

1-1 Introduction

This manual contains all the information normally required to operate and maintain the Minimite and MultiMite. The serial number on the name plate on the rear or side of the case identifies each instrument. Always refer to the serial number and model number in correspondence or when ordering replacement parts. MiniMites to be used in a MultiMite case, a flanged case for panel mounting, or with a Constant Voltage Supply are supplied with an aluminum panel and case. See Addendum for panel mounting instruction. Operation is the same for all models.

1-2 Application

This manual covers the operation and maintenance of standard models as described in the Thermo Electric MiniMite and Multi-Mite Catalog.

1-3 General Description

The MiniMite is a highly accurate, compact hand portable instrument which, depending on the model selected, can be used to:

1. Measure temperature directly, using a thermocouple.
2. Measure millivolt signals directly.
3. Calibrate potentiometer-type instruments.
4. Calibrate millivoltmeter-type instruments.

The MiniMite employs a null balance potentiometer circuit which eliminates loading effects incurred when taking measurements. Measurements are indicated on the self-contained galvanometer.

Current required by the measuring circuit is supplied by a "D" cell battery. The battery is replaced after removing the case.

Reference junction compensation is automatic. A temperature sensitive resistor is connected internally to the instrument binding posts. The MiniMite has been constructed for use in a vertical or horizontal position. Models are available for panel mounting.

The MultiMite is available in either a six or twelve point model. The six point model is a combination of a MiniMite and a variable

direct current source. Six thermocouple or millivolt inputs can be connected to the MultiMite simultanuously. A six point switch provides selection of input. Readings are made in Fahrenheit, Celsius or millivolts on the MiniMite scale. A "D" cell battery supplies the current needed when calibrating moving coil instruments. The battery is replaced after first removing the MiniMite and then removing the battery through the vacant hole. The twelve point model consists of a MiniMite and a twelve point selector switch. It despenses with the D'Arsonval meter calibration capability to provide rapid switching of twelve thermocouple or millivolt inputs.

1-4 MiniMite Specifications

Scale: Dual Range, 23.6 inches long
Accuracy: ±0.25% of scale span
Galvanometer: Zero-center scale with 1mm divisions
Reference Junction Compensation: Fully automatic-all temperature ranges
Ambient Temperature Range: 40^{o} to 140^{o}F
Voltage Reference: *Standard cell
Battery: *"D" cell, 1.5 volts

*Model 31107 utilize a Constant Voltage Supply (CVS) to eliminate battery replacement and standardizing. See Addendum for description.

MultiMite Specifications

External Resistance: Up to 200 ohms without loss of accuracy
Battery: "D" cell 1.5 volts type-6 pt. only
Terminals: Insulated color coded binding posts with retained caps. Will accomodate flat terminals or wire to 12 AWG.
Dimensions: 12"L x 8 1/2"W x 7 3/4"H
Weight: 11 pounds

1-5 Principles of Operation

The Potentiometer Circuit is an accurate and reliable means of determining potential and therefore, thermocouple temperature. Figure 1 illustrates the operation of a simplified potentiometer circuit.

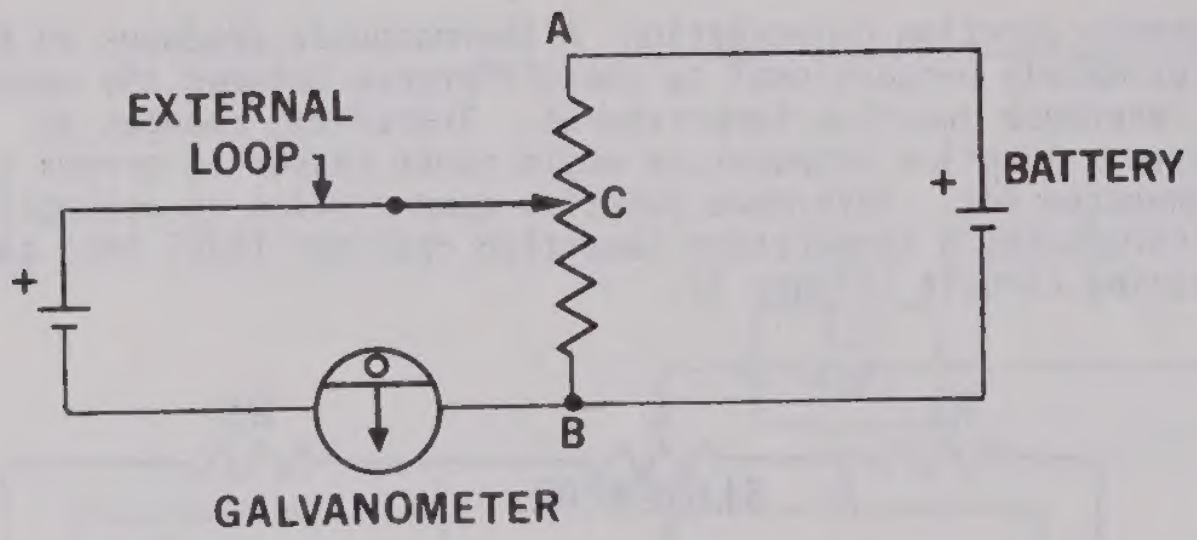


Figure 1 - Typical Potentiometer Circuit

The battery delivers a current which causes a potential drop along the potentiometer slidewire from points A to B. The slidewire is a precision linear resistance wire with an adjustable contact that can be moved along the length of the slidewire. To measure the unknown potential, the contact is moved along the slidewire until the potential drop from C to B is equal and opposite to the unknown potential. At the point of equal potentials, or null balance, the error signal is zero causing a zero indication on the galvanometer. The voltage across CB is equal to the voltage across AB times the distance of C to B divided by the distance of A to B.

NOTE: The length or resistance of the connecting lead wires will not affect the accuracy of the system since, in the balanced condition, no current flows in the external loop. The sensitivity will be affected but this is minimized by suitable design in the balancing system.

Standardization, or the comparison of the slidewire potential to a known EMF, is required for accurate measurements. This is accomplished by adding a standard cell and regularly comparing the measuring circuit potential to the standard cell. During standardization, the balance is switched from the external loop and placed in series with the standard cell. When the standardizing switch is closed, the battery rheostat is adjusted until the galvanometer indicates zero current flow. Zero current flow, or a balanced condition, indicates that the slidewire circuit is at the same potential as the standard cell.

Reference Junction Compensation A thermocouple produces an EMF approximately proportional to the difference between the measuring and reference junction temperatures. Therefore, changes in reference junction temperature would cause measuring errors unless compensated for. Reference junction compensation is accomplished by introducing a temperature sensitive resistor (RJC) into the measuring circuit (Figure 2).

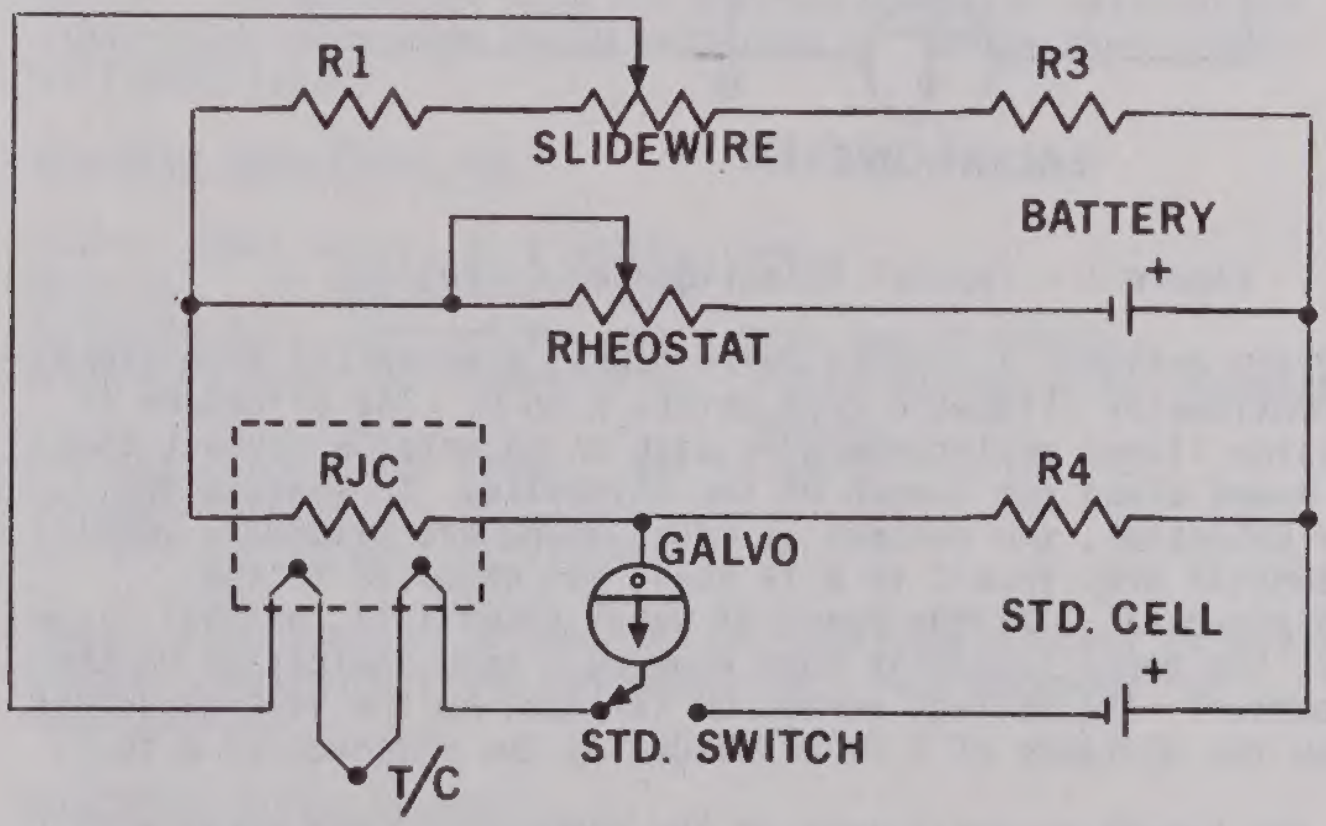


Figure 2 - Typical Potentiometer Pyrometer Circuit

Resistor RJC is in close proximity with the reference junction and for all practical purposes they are at one and the same temperature. The resistance of RJC varies directly with the temperature at the reference junction thereby compensating for any changes in ambient temperature.

When the MiniMite is used for measuring temperature or millivolts, the low level DC input signal from the sensing element is compared with the slidewire setpoint level in the potentiometer measuring circuit. Any unbalance between the two results in an error signal which is indicated by the galvanometer, provided that the function selector switch is in the OPERATE position and the TEST pushbutton switch is depressed.

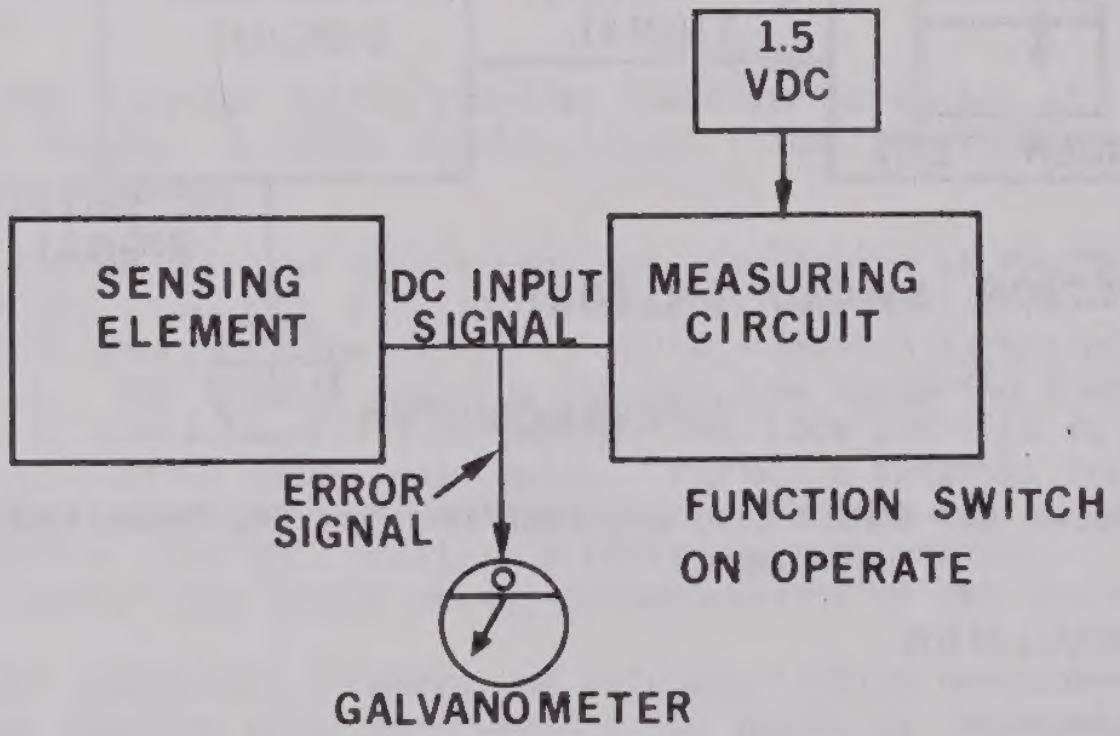


Figure 3 - Block Diagram, MiniMite Measuring Millivolt Signals

When the MiniMite is used for checking or calibrating potentiometer-type instruments, a low level DC signal corresponding to the scale setting is made available at the EMF binding posts, provided that the function selector switch is in the LOCK position and the TEST pushbutton switch is depressed. This signal, when connected to the instrument under test, is compared with its slidewire setpoint level. Any unbalance between the two results in an error signal which may be mechanically or electrically balanced, depending on whether the instrument under test is self balancing or not.

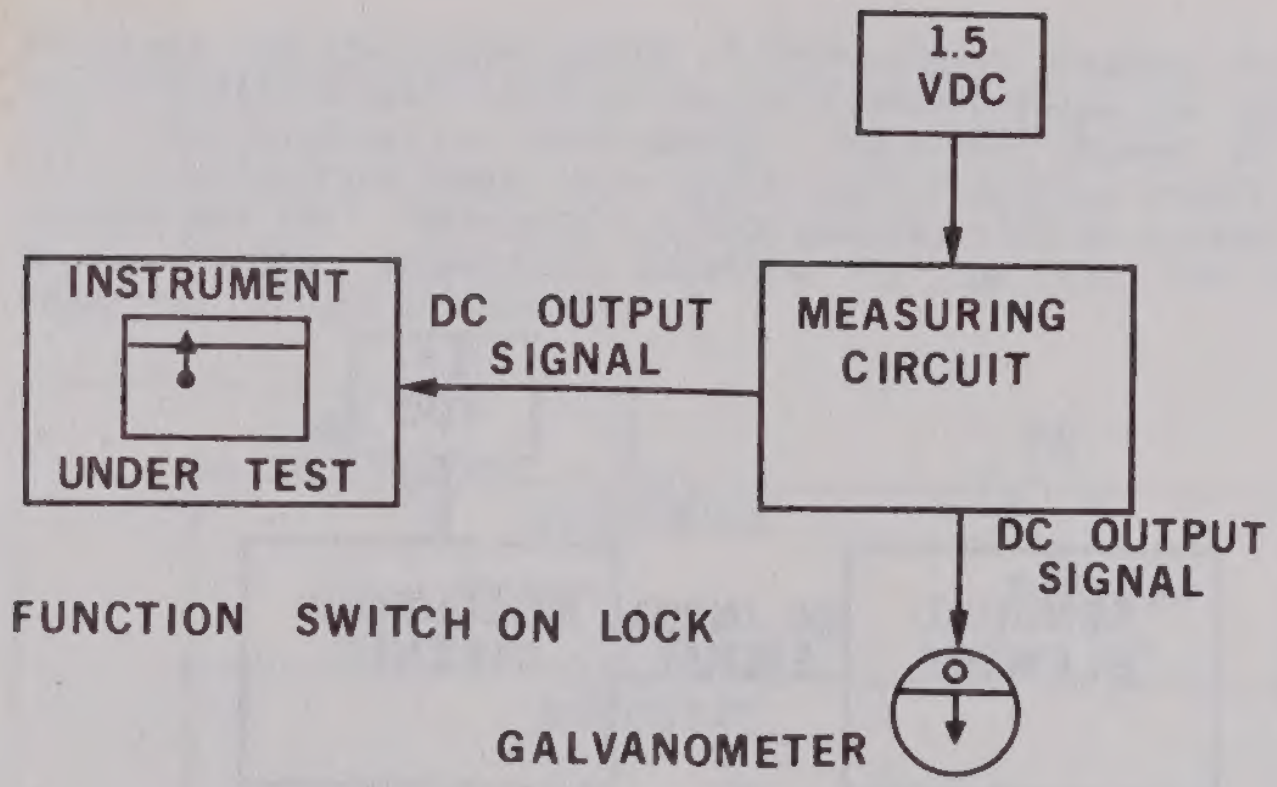


Figure 3A - Block Diagram, MiniMite Checking Potentiometer-type Instruments

2-0 INSTALLATION

2-1 Unpacking

Unpack immediately upon receipt and check for shipping damages. If not to be used immediately, remove battery(s) and repack in carton. Instruments are usually shipped with small accessory items in the same box. Check all items against the packing list before discarding the shipping container and packing material.

2-2 Location

The MiniMite and MultiMite should be operated in an area which remains within the ambient temperature limits of 40 to 140^{o}F (4.4 to 60^{o}C).

2-3 Mounting

The MiniMite is a portable instrument designed for table or bench use. Flush mounting is accomplished with a flanged case (see Addendum) which is available on special order. The MultiMite is designed for table top use.

3-0 OPERATING INSTRUCTIONS

3-1 Operating Controls, MiniMite

The standard adjust (STD. ADJ.) knob permits an adjustment of the battery rheostat to compensate for any variation in battery voltage.

The RANGE selector switch provides immediate selection of either of two ranges. A simple graphic layout visually indicates the selected range.

The function selector switch provides a selection of MiniMite operations. The STD. position is used to standardize the measuring circuit. The switch is spring-returned to the OPERATE position. The OPERATE position is used when measuring thermocouple or absolute millivolt inputs. The LOCK position is used when calibrating other instruments. The scale settings are made available at the EMF terminals without deflecting the galvanometer. In addition, The LOCK position effectively protects the galvanometer from damage during transportation of the MiniMite.

The TEST pushbutton is depressed only when taking measurements or when checking other instruments. It should be released when standardizing. The switch is a "push-push" type. Push to engage, push to release.

The THUMBWHEEL positions the instrument slidewire and the indicator scale to which it is coupled. A zero deflection of the galvanometer will position the scale at the value of the measured EMF.

Operating Controls, Six Point MultiMite

The Rotary Selector Switch (OFF to 6) will deliver the millivolt input corresponding to the point selected to the MiniMite input terminals provided that the shorting bars are connected between the output of the switch and the EMF terminals of the MiniMite.

The MILLIVOLT COARSE and BATTERY SWITCH will deflect the coil of the millivoltmeter under test provided the battery is switched from the OFF position. In the OFF position the direct current source is removed from the circuit.

The MILLIVOLT FINE adjustment is in the circuit when the BATTERY SWITCH is on. This adjustment will bring the moving coil of the instrument under test to the exact calibration point desired.

The EXTERNAL RESISTANCE potentiometer allows for matching the external resistance of the millivoltmeter under test. The resistance is adjustable from 0 to 20 ohms or 0 to 100 ohms, depending on model.

Operating Controls, Twelve Point MultiMite

The rotary selector switch (OFF to 12) will deliver the millivolt input corresponding to the point selected to the MiniMite input terminals provided that the shorting bars are connected between the output of the switch and the EMF terminals of the MiniMite.

3-2 Operating Procedures

The instrument is shipped with all parts in place ready for operation. Proceed as follows:

A. MECHANICALLY ZERO THE GALVANOMETER. Turn the function switch to the OPERATE position and by means of a small screwdriver, adjust screw until the galvanometer pointer is at zero. This operation should be made everytime the MiniMite is changed from one operating plane to another.

B. ELECTRICALLY STANDARDIZE THE MEASURING CIRCUIT. Turn the function switch to the STD. position and hold while adjusting the standard adjust knob (STD. ADJ.) until the galvanometer is at zero. The TEST pushbutton should be released when the instrument is being zeroed or standardized.

C. THE MINIMITE IS NOW READY FOR OPERATION. It should be noted that accurate temperature measurements and precise calibration checks will depend largely upon the care exercised in zeroing and standardizing the instrument. (Unit should be standardized when range is changed).

3-3 MEASURING TEMPERATURE USING A THERMOCOUPLE

MiniMite Equipped with a Temperature Scale Calibrated to the Same Curve as the Thermocouple Employed

1. Connect the thermocouple extension leads from the thermocouple to the MiniMite terminal posts observing polarity. Be sure connections

are secure. If measurements are to be made through the MultiMite, the thermocouple extension leads may be connected to the MultiMite input terminals. The BATTERY SWITCH should be OFF.

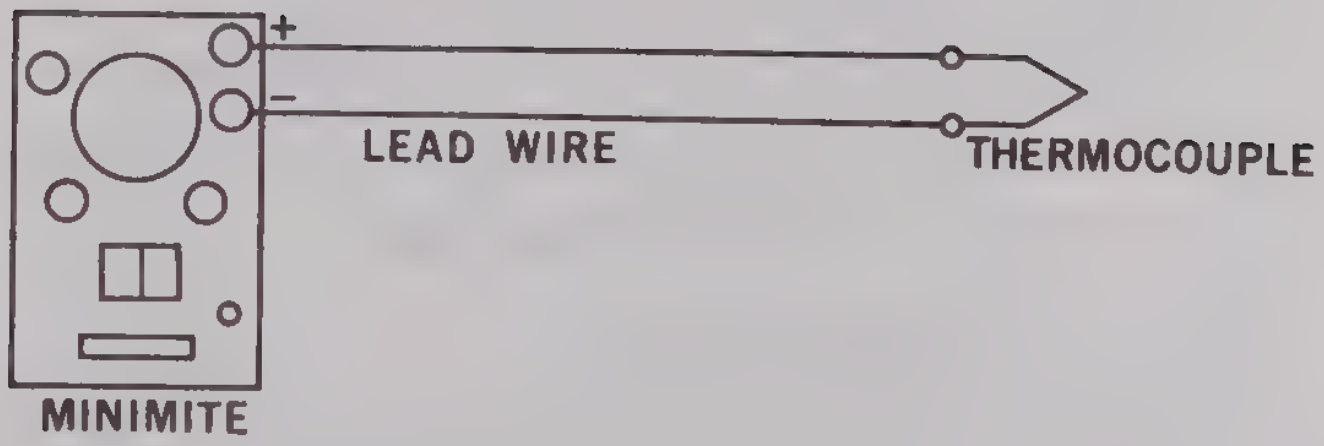
2. Move the Range Selector Switch to the scale range corresponding to the calibration of the thermocouple employed.
3. Depress the TEST button. The galvanometer pointer will deflect. Turn the thumbwheel until the pointer is at zero and read the thermocouple temperature directly on the scale.

MiniMite Equipped with a Millivolt Scale

1. Connect the thermocouple extension leads from the thermocouple to the MiniMite terminal posts observing polarity. Be sure connections are secure. If measurements are to be made through the MultiMite, the thermocouple extension leads may be connected to the MultiMite input terminals. The BATTERY SWITCH should be OFF.
2. Move the Range Selector Switch to the MV position.
3. Depress the TEST button. The galvanometer pointer will deflect. Turn the thumbwheel until the pointer is at zero and read the millivolt value directly on the scale.
4. The scale reading in millivolts must now be corrected for reference junction (terminal post) temperature and converted back into the temperature corresponding to the calibration of the thermocouple employed.
5. Measure the reference junction temperature using a glass thermometer.
6. Using a temperature-millivolt table corresponding to the calibration of the thermocouple employed, convert the reference junction temperature to millivolts and algebraically add this millivoltage to the scale reading determined in Step 3.
7. Translate millivolts into temperature. The result is the true temperature of the thermocouple.

Example:

Type thermocouple employed	Chromel-Alumel
Measured millivoltage	+7.24 MV
Reference junction temperature	85°F
85°F From Table = 405°F	+0.23 MV ISA-K
	+7.47 MV ISA-K



3-4 CHECKING POTENTIOMETER-TYPE INSTRUMENTS

Direct Thermocouple Reading

The calibration of potentiometer-type instruments may be checked by reading the thermocouple temperature using the instrument under test and then comparing this reading with the MiniMite reading. The MiniMite is used with a test thermocouple located adjacent to the thermocouple of the instrument under test. This is a quick, but at times inaccurate, method of calibration, since adjacent thermocouples may not be at equal temperatures.

Direct Comparison of Instruments with a MiniMite Calibrated to The Same Curve as The Instrument Under Test

1. Connect the MiniMite or MultiMite to the instrument with thermocouple extension leads of the proper calibration. If the MultiMite is to be used, The BATTERY SWITCH should be OFF.
2. Turn the function switch to the LOCK position.
3. Depress the TEST button.
4. Turn the thumbwheel until the desired checkpoint is reached.
5. Balance the potentiometer circuit of the instrument under test. Recorders and self-balancing indicators will balance automatically. Indication of instrument should be the same as that of the MiniMite.

Direct Comparison of Instruments with a MiniMite Equipped with a Millivolt Scale.

1. Connect the MiniMite or MultiMite to the instrument under test with copper leads. Polarity must be observed. If the MultiMite is to be used, the BATTERY SWITCH should be OFF.
2. Turn the Range Selector Switch to the appropriate millivolt scale.
3. Turn the function switch to the LOCK position.
4. Depress the TEST button.
5. Turn the thumbwheel until the desired check point is reached.
6. Balance the instrument under test, or if self-balancing, permit the recorder or indicator to reach a stable indication.
7. If the instrument under test is equipped with a millivolt scale, the reading in millivolts may be directly compared with the Mini-Mite. However, if the instrument under test indicates in calibrated scale units such as temperature, this must be converted to equivalent millivolts at its terminals.
8. If the instrument under test does not have cold junction compensation, refer to a temperature-millivolt table for the design reference temperature at the desired check point to determine the corresponding millivolt indication.
9. If the instrument under test employs a cold junction compensator, correction must be made for the effect of its actual temperature. Measure the reference junction temperature of the instrument under test with a thermometer located at the input terminals. Find the corresponding millivolt value in the correct calibration temperature-millivolt table.
10. Using the same table, find the millivolt value corresponding to the selected check point reading of the instrument under test.
11. Algebraically subtract the millivolt value corresponding to the selected check point. This will give the actual millivolts at the terminals of the instrument under test and this may be compared with the MiniMite millivolt indication.

Example: Compensating resistor for ISA-K
Cold junction temperature = 85°F
Corresponding millivolt value for 85°F ISA-K=0.23MV
Check Point 500°F
Corresponding millivolt value for 500° ISA-K=9.62MV
9.62 millivolts
-0.23 millivolts
9.39 millivolts

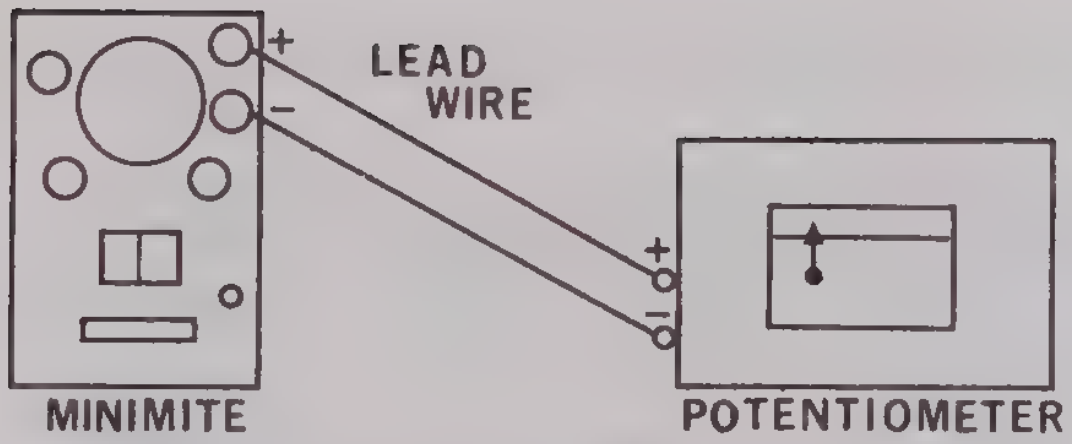


Figure 5 Checking Potentiometer-type Instruments

3-5 CALIBRATING MILLIVOLTMETER-TYPE INSTRUMENTS

Quick Calibration Method

A quick method of calibrating millivoltmeter-type instruments follows: Hook a test thermocouple to the MiniMite and place it next to the instrument thermocouple. Compare the readings of the instrument and MiniMite. Nearly identical readings mean the instrument is properly calibrated. Deviation is possible however if a temperature gradient exists between the two thermocouples.

Calibration Using a MultiMite Equipped with a Temperature Scale

When calibrating millivoltmeter-type (moving cell) instruments with the following method, a variable direct current source is required in conjunction with the MiniMite. Thermo Electric's Six Point MultiMite which has a self contained current source, was specifically designed for this purpose. Instructions for checking millivoltmeter instruments with this MultiMite are listed below:

1. Move the RANGE SELECTOR SWITCH on the MiniMite to the appropriate temperature scale.
2. Standardize the MiniMite per instructions given in Section 3-2 B.
3. Switch the MiniMite to the OPERATE position.
4. Short circuit the EMF terminal posts of the MiniMite with a short length of copper wire.
5. Depress the TEST button. The galvanometer pointer will deflect. Turn the thumbwheel until the galvanometer pointer is at zero.

Read the temperature on the appropriate range scale. This reading indicates the MiniMite cold junction temperature or the temperature at the MiniMite terminal posts.

6. Short circuit the terminal posts of the millivoltmeter being tested with a short length of copper wire.
7. Adjust the millivoltmeter to read the same temperature as determined in step 5.
8. Remove the terminal shorting wires from both instruments. Connect copper leads from one set of terminal posts on the MultiMite to the millivoltmeter. Observe Polarity. The copper leads used should be 20 AWG or larger and limited to a length of 6 feet or less. The external resistance of the interconnecting wire will then be limited to less than 0.1 of an ohm and can be neglected. Turn the rotary selector switch to the point you have connected.
9. Check the external resistance rating of the millivoltmeter to be tested. This value is usually marked on the scale. Turn the EXTERNAL RESISTANCE adjustment on the MultiMite to that specified for the millivoltmeter.
10. Turn the Mv COARSE Switch to LOW. Set the Mv FINE to HIGH. With the Mv COARSE control deflect the millivoltmeter pointer to its full scale setting. The Mv FINE can then be used to adjust the pointer to the exact setting.
11. Depress the TEST button. Turn the thumbwheel until the MiniMite galvanometer pointer is at zero. The millivoltmeter should read the same as the MiniMite. The millivolt meter may be deflected to several points on the scale to accurately check the overall calibration. Ideally, three points should be checked: 10% of full scale, midscale and 90% of full scale.

Calibration Using A MultiMite Equipped With A Millivolt Scale

When calibrating millivoltmeter-type (moving coil) instruments with the following method, a variable direct current source is required in conjunction with the MiniMite. Thermo Electric's Six Point MultiMite, which has a self contained current source, was specifically designed for this purpose. Instructions for checking millivoltmeter instruments with this MultiMite are listed below:

1. Move the RANGE SELECTOR SWITCH on the MiniMite to the appropriate millivolt scale.
2. Standardize the MiniMite per instructions given in Section 3-2 B
3. Switch the MiniMite to the OPERATE position.

4. Short circuit the millivoltmeter terminal posts with a short length of copper wire.
5. Adjust the millivoltmeter to read 75°F, 25°C or zero millivolts.
6. Remove the terminal shorting wire from the millivoltmeter and connect copper leads from a set of terminal posts on the Multi-Mite to the terminal posts of the millivoltmeter. Observe Polarity. The copper leads used should be 20AWG or larger and limited to a length of 6 feet or less. The external resistance of the interconnecting wire will be limited to less than 0.1 of an ohm and can be neglected. Turn the rotary selector switch to the point you have connected.
7. Check the external resistance rating of the millivoltmeter being tested. This value is usually marked on the scale. Turn the EXTERNAL RESISTANCE adjustment on the MultiMite to that specified for the millivoltmeter.
8. Turn the Mv COARSE Switch to LOW. Set the Mv FINE to HIGH. With the Mv COARSE control, deflect the millivoltmeter pointer to its full scale setting. The Mv FINE can then be used to adjust the pointer to the exact setting to be checked.
9. Depress the TEST button. Turn the thumbwheel until the Mini-Mite galvanometer pointer is at zero. If the millivoltmeter is equipped with a millivolt scale, the reading in millivolts may be directly compared with the MiniMite. If the millivoltmeter indicates in calibrated scale units such as temperature, however, this must be converted to equivalent millivolts. Refer to a temperature-millivolt table to determine the corresponding millivolt indication. A table referenced at 75°F (25°C) should be used.

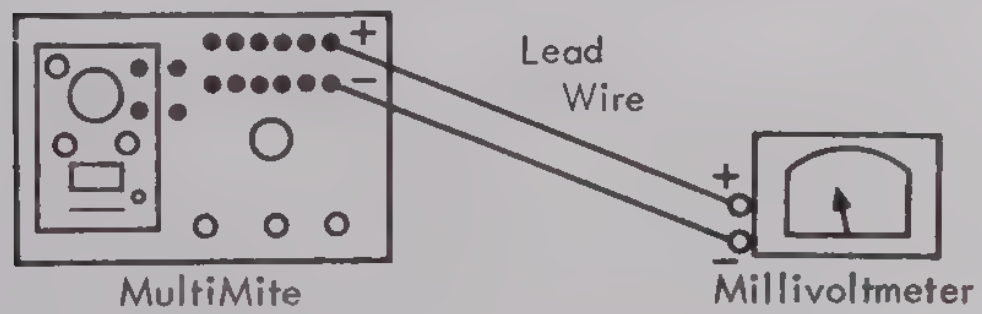


Figure 6 Checking Millivoltmeter-type Instruments with a MultiMite

4-0 MAINTENANCE

4-1 Preventive

When the MiniMite or the MultiMite is in transit or when being carried in the course of routine portable testing, the function selector switch should be placed in the lock position. This effectively "shorts" the galvanometer to dampen oscillation.

4-2 Periodic

When it is no longer possible to standardize the MiniMite circuit by turning the STD. ADJ. knob, install a new battery. To replace:

1. Remove the camera screw from the rear of the case and remove the case.
2. Remove the battery and replace with a fresh size D flashlight battery observing polarity.
3. Replace the case and camera screw.

CAUTION

Do not place the function selector switch in the STD. position unless the battery is installed, otherwise a severe current drain will be placed upon the standard cell which will affect its accuracy.

5-0 TROUBLESHOOTING

5-1 General

Before attempting troubleshooting procedures, check to see:

1. If the battery is at the proper operating voltage, installed correctly and making good contact.
2. If all connections are properly attached and made.

5-2 Troubleshooting Guide

Symptoms of Trouble	Possible Causes
Galvanometer needle will not move when standardizing or when measuring input.	Galvanometer damaged internally. To check: (a) Disconnect it from the MiniMite circuitry and

	Place a 200 ohm resistor across its terminals. It should balance at zero. (b) With a 60 microvolt input, it should deflect one division or more.
Standardizing difficult or unstable.	1. Test switch not released. 2. Battery not making good contact with battery holder. 3. Standardizing adjust pot faulty.
Galvanometer deflects against stop when standardizing. MiniMite will not standardize.	1. Galvanometer deflects to low side: Battery low or not making contact. 2. Galvanometer deflects to high side: standard cell low or open.
Galvanometer will not balance when reading a known emf with MiniMite	1. Slidewire open. 2. Zero adjust open. 3. Resistor shorted or open. 4. Compensator shorted or open. 5. Broken wire in circuitry. 6. Switch faulty.

5-3 Replacement Parts

When ordering replacement parts, always refer to the serial number and model number stamped on the instrument nameplate.

Description	T.E. Part Number
Binding post terminal, black	7552-1
Binding post terminal, red	7552-2
Galvanometer	A-1751
Battery, 1.5 VDC Size D	7937
Standard Cell	7633
Test Switch	A-5372
ındardizing adjustment rheostat	A-1761
.ob, Range and function selector switch	A-6323

Knob, standardizing adjustment	A-6362
Leather carrying case with strap	A7858
Nylon Screw	A7849-1
Compensating resistor	A-1780- *
Scale	7551- *
1004.3 ohm resistor	7670-281
300 ohm resistor	A4055-1
15 ohm resistor	7670-280
Shunt adjust trimpot (0 to 200 ohms)	A5341
Zero Adjust Assembly	A1900

See Appendix (Parts Identification) for additional components and part numbers.

*Dash number depends on Range and calibration

Components mounted on the front panel can be replaced after first removing the front dress panel.

6-0 CALIBRATION

6-1 Adjustments

Dial Drum The scale should wrap snugly around the dial drum. If it is loose, the spring tension on the scale rewind drum may have to be increased. The scale should be readable at both ends. If part of the scale is mechanically impossible to read, the dial drum's position on the slidewire shaft may have to be adjusted. This may be done by loosening the two set screws on the large brass gear. Set so the entire scale is readable. Re-tighten screws.

Zero Adjust There are two zero adjust screws for each instrument; one for each range. These adjustments may be quickly located by referring to the Parts Indentification in the Appendix. The top screw is used for the upper range to adjust the level of the voltage across the measuring circuit. The bottom screw adjusts the voltage of the lower range.
To adjust: loosen the adjust screw slightly and move the contact up or down the slidewire as desired. Re-tighten screw.

Span Adjust Depending on the model number, there may be one or two span adjust trimpots. Refer to the Parts Identification in

the Appendix for location. The trimpots (0 to 200 ohms) are used in series with fixed 300 ohm resistors and are used to adjust the millivolt span of each range. The trimpots are labeled SPAN ADJ. UP for the upper scale and SPAN ADJ. LO for the lower scale. They are located on the range card board. If only one trimpot is available, it will adjust the millivolt span of both ranges.

6-2 Method

Equipment:

1. Precision laboratory potentiometer
2. External galvanometer (may be part of precision Potentiometer)
3. Calibrated reference junction thermocouple (material leads of the same calibration as the MiniMite) with copper extension leads for cold junction simulation
4. Thermocouple EMF vs Temperature conversion table, 32°F (0°C) reference temperature
5. 32°F (0°C) ice bath

Procedure:

1. Connect equipment as shown in Figure 7.
2. Zero and standardize the MiniMite as described in Section 3-2, Paragraphs A and B
3. Set MiniMite function switch to LOCK position.
4. Set MiniMite Range Selector Switch to range to be calibrated.
5. Set the MiniMite scale so that its lowest reading (first increment of the scale at the low millivolt end) is read on the index hairline.
6. Zero and standardize the precision potentiometer.
7. Refer to the EMF vs Temperature table and set the precision potentiometer to the millivolt value corresponding to the Mini-Mite scale setting.
8. Depress the MiniMite TEST switch. If an error exists the external galvanometer will deflect.
9. Correct any error by adjusting the zero adjust screw corresponding to the range selected.
10. Set the MiniMite scale so that its highest reading (last increment of the scale at the high millivolt end) is read on the index hairline.

11. Repeat steps 7 and 8
12. Correct any error by adjusting the span adjust trimpot corresponding to the range selected.
13. Repeat steps 5 through 12 until the error is minimal.
14. Set the MiniMite scale so that its midpoint is read on the index hairline.
15. Repeat steps 7 and 8.
16. If an error exists which is over the tolerance of ±1/4%, adjust the zero adjust screw to split the error over the entire scale. It may be necessary to readjust the dial drum's position on the slidewire shaft in conjunction with adjusting the zero adjust screw.

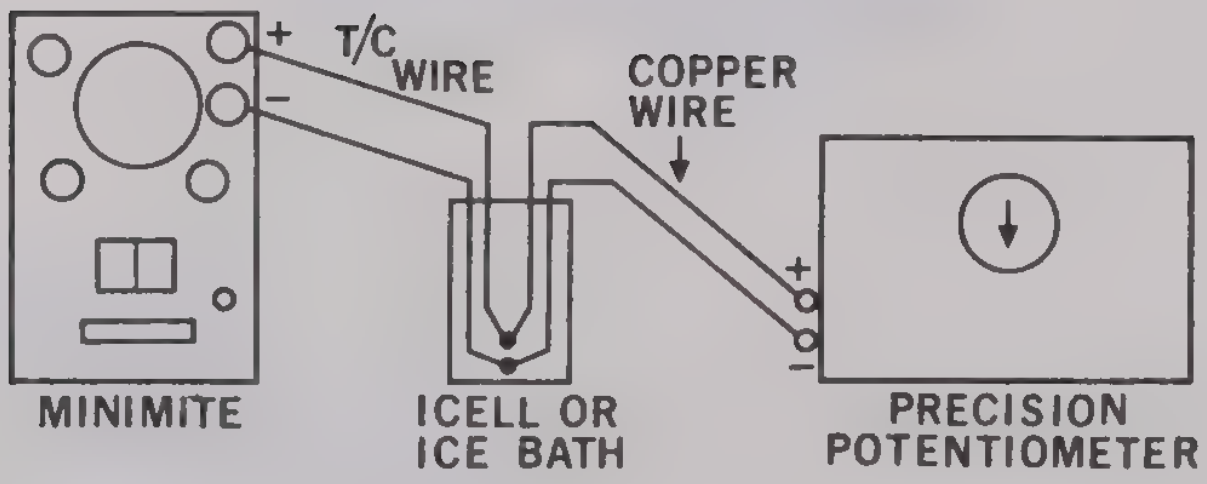
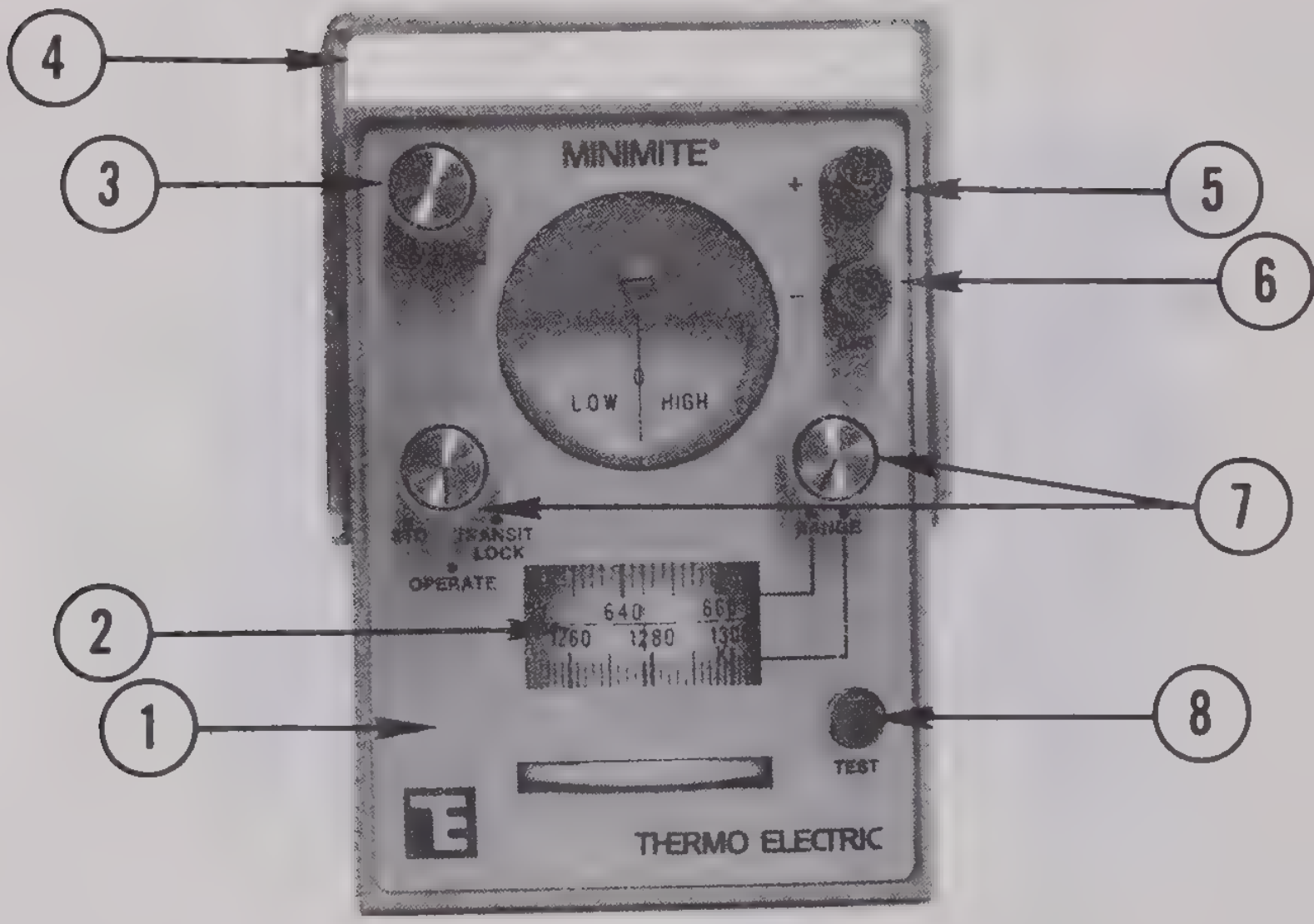


Figure 7 MiniMite Calibration with Precision Laboratory Potentiometer

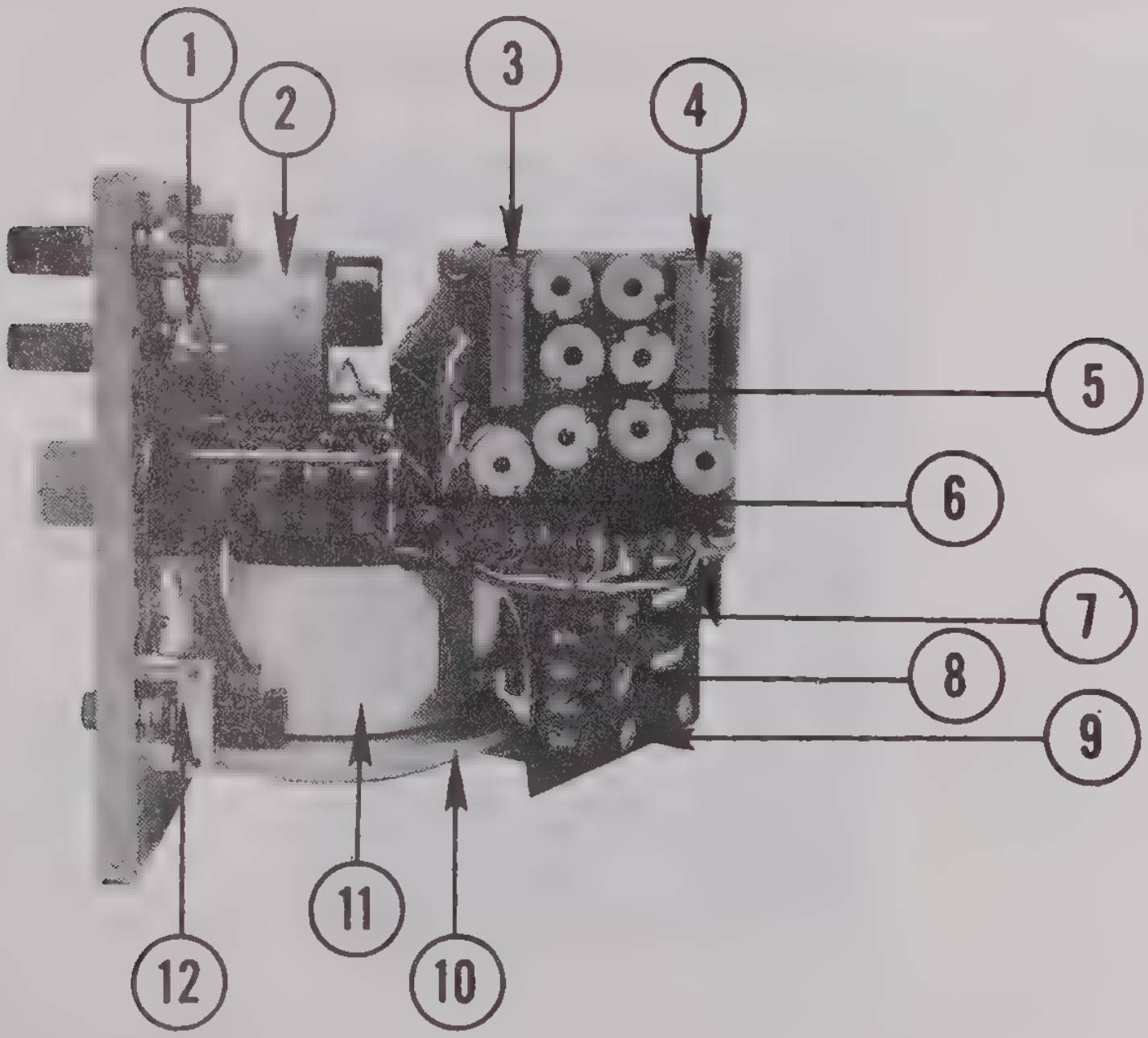
7-0 APPENDIX

7-1 Photographs, Parts Identification



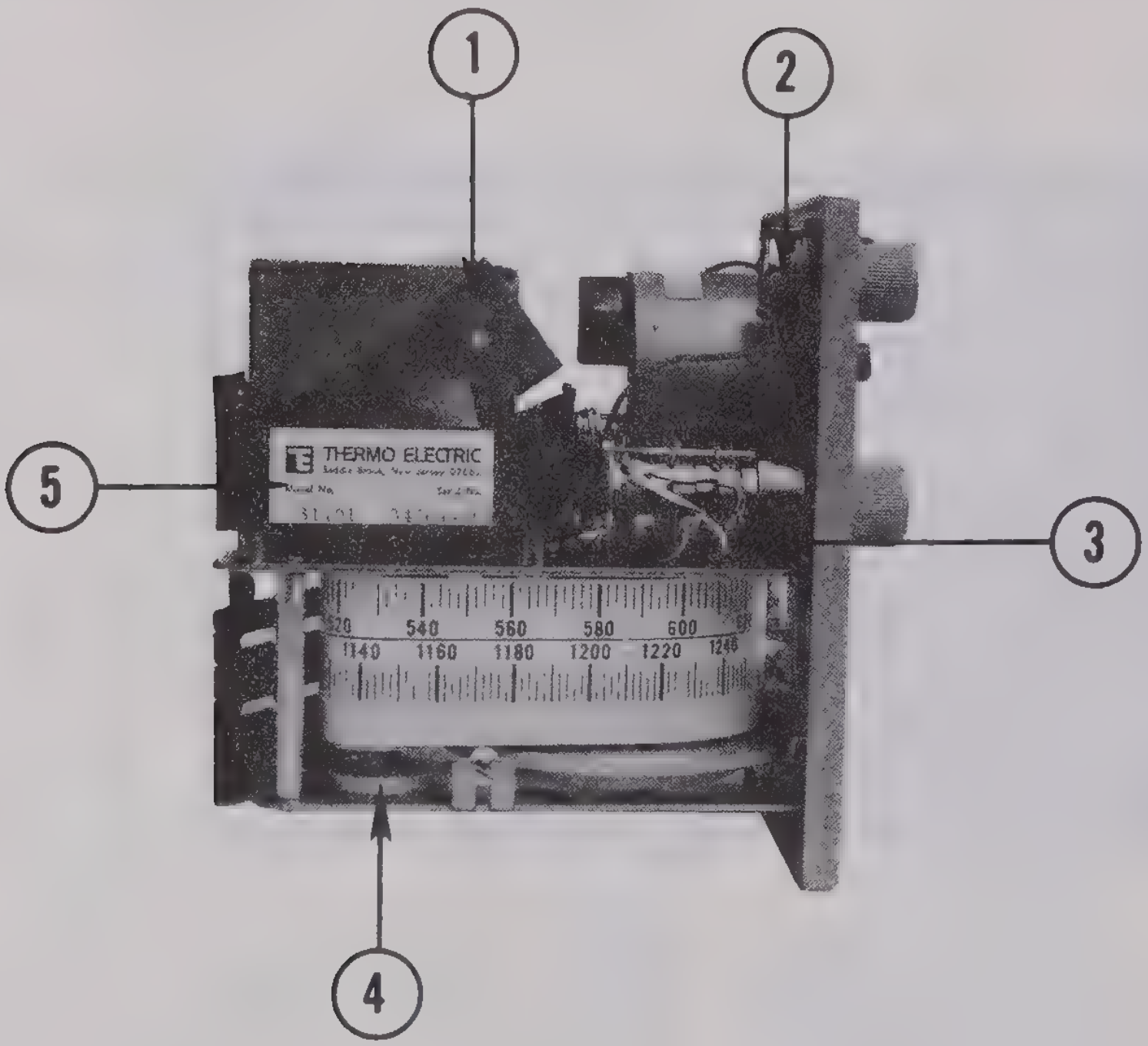
1. Panel, front (A5336) dress (A-5440)
2. Window (A6331)
3. Knob, standard adjust (A6362)
4. Carrying Handle
5. Terminal, black (7552-1)
6. Terminal, red (7552-2)
7. Knob, selector switches (A6323)
8. Push button switch (A5372)
   case assembly, not shown (A5395)

Thermo Electric part numbers appear in parenthesis.

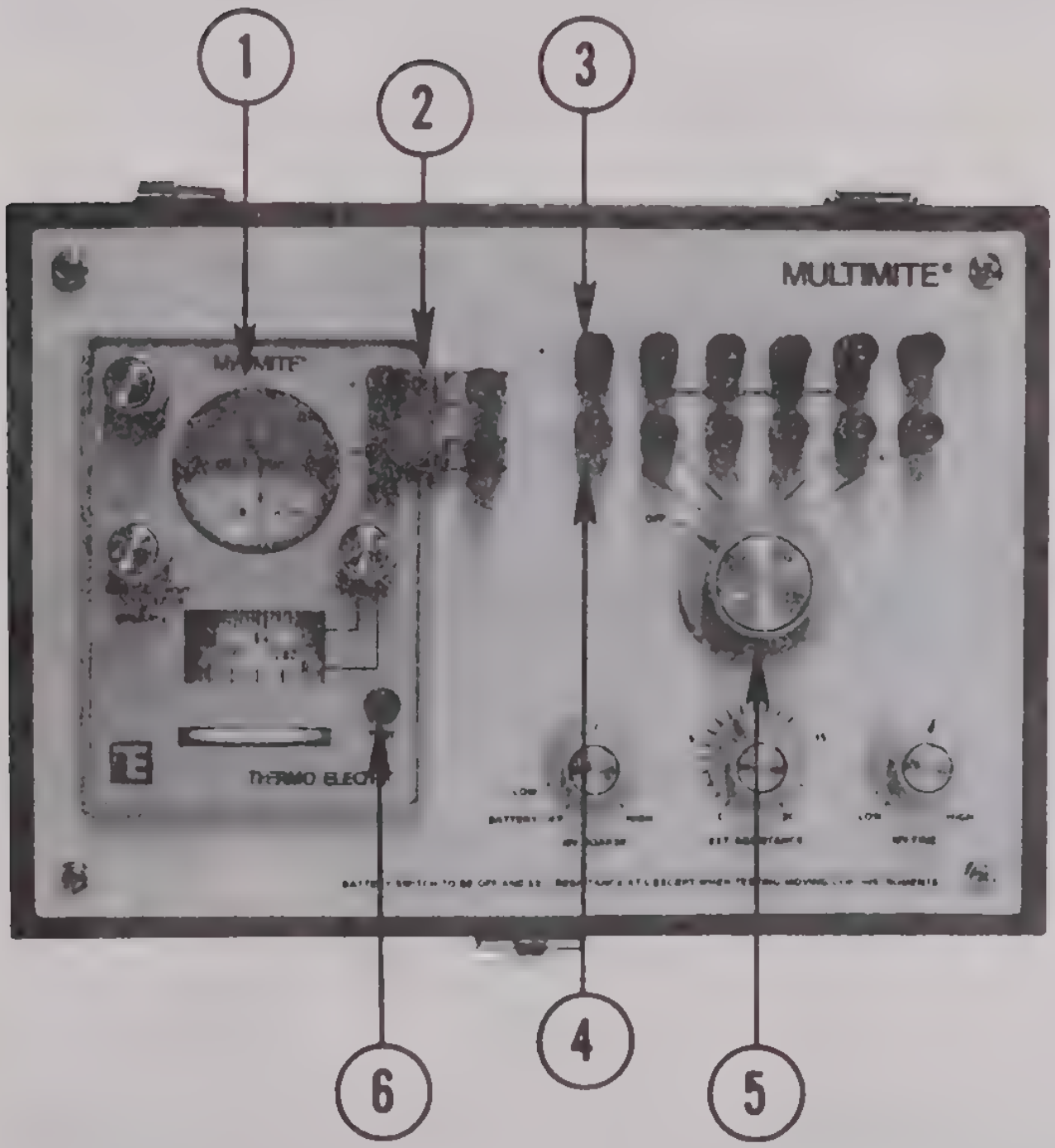


1. Reference Junction Compensator (A1780- □)*
2. Galvanometer (A1751)
3. Span Adjust Trimpot (lower range)
4. Span Adjust Trimpot (upper range)
5. Range Card Assembly (A5350- □)
6. Range Switch (A1778) Wired (A2040)
7. Zero Adjust (upper range)
8. Zero Adjust (lower range)
9. Zero Adjust Assembly (A1900)
10. Thumbwheel
11. 23.6 inch scale (7551- □)*
12. Test Switch (A5372)

Thermo Electric part numbers appear in parenthesis.
*Dash number depends on range and calibration.

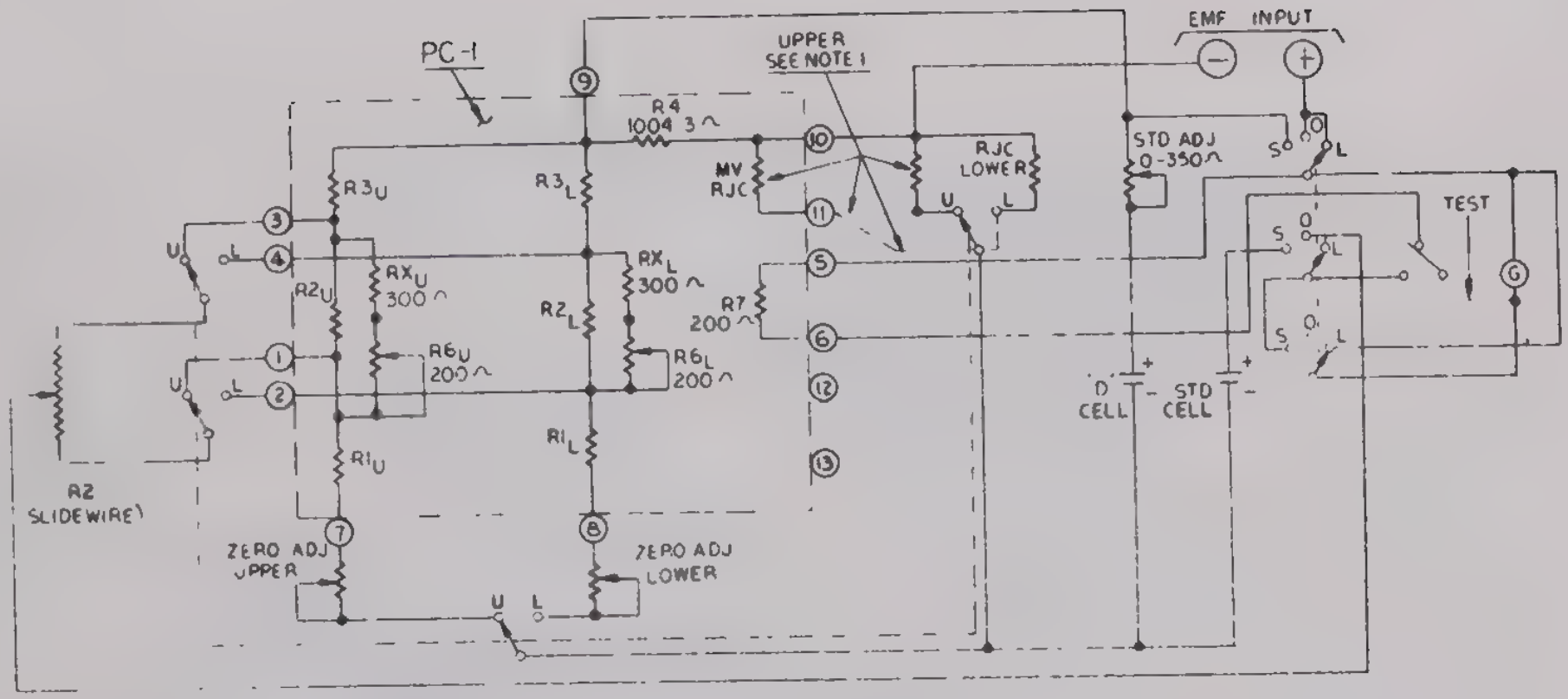


1. Standard Cell (7633)
2. Standardizing Adjustment Rheostat (A1761)
3. Function Selector Switch (A1777) Wired (A2039)
4. Rewind Drum Assembly (7646)
5. Battery Holder (A5343) for 1.5 VD C size D Battery (7937)



1. MiniMite Assembly
2. Shorting Bars (A-4344)
3. Terminals, black (7552-1)
4. Terminals, red (7552-2)
5. Selector Switch Knob
6. MiniMite Test Switch

Thermo Electric part numbers appear in parenthesis.



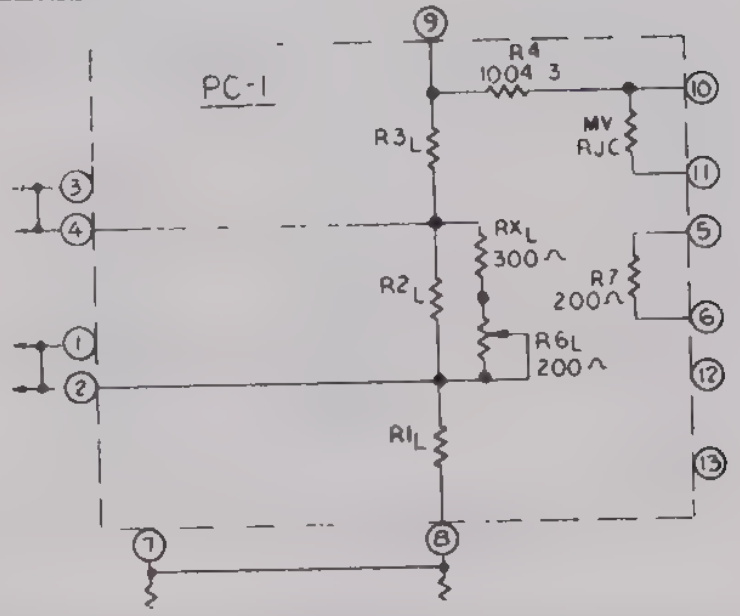
FOR SCALES WITH SAME SPAN DIFFERENT END POINTS

NOTES

1. MV RJC IS USED ONLY WHEN ONE SCALE IS A MILLIVOLT RANGE

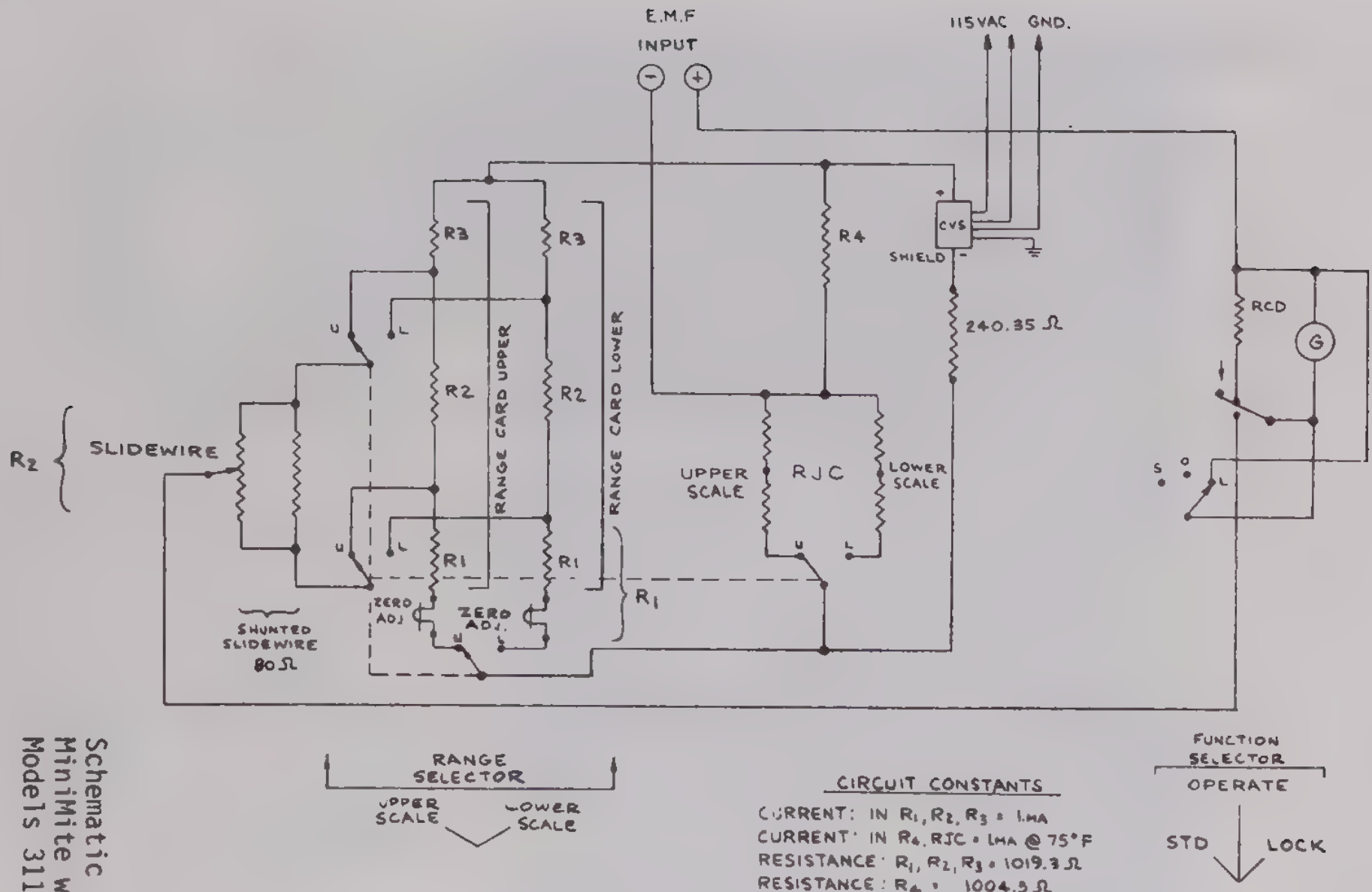
2. CIRCUIT CONSTANTS

CURRENT - IN R1, R2, R3 - 1 MA
CURRENT - IN R4, RJC = 1MA AT 75°F
RESISTANCE - R1, R2, R3 - 1019.3 ∧
RESISTANCE - R4 - 1004.3 ∧
RESISTANCE - RJC - 15.0 ∧ AT 75°F
RESISTANCE - "D" CELL ADJ - 350 ∧
RESISTANCE - CRITICAL DAMPING (R7 / R8) = 200 ∧ (T.E.NO. 7241-32)
RESISTANCE - ZERO ADJUSTERS - 1. ∧ (FOR R ±.5 ∧)
RESISTANCE - SHUNTED SLIDEWIRE - 80 ∧
VOLTAGE ACROSS STD CELL - V (R1, R2, R3, R4, RJC) = 1.0193V
VOLTAGE ACROSS RJC - 15MV AT 75°F
VOLTAGE "D" CELL MAX. - 1.72 V
MIN. - 1.0198 V



FOR SCALES WITH SAME SPAN SAME END POINTS

Schematic Diagram
MiniMite
Model 31101

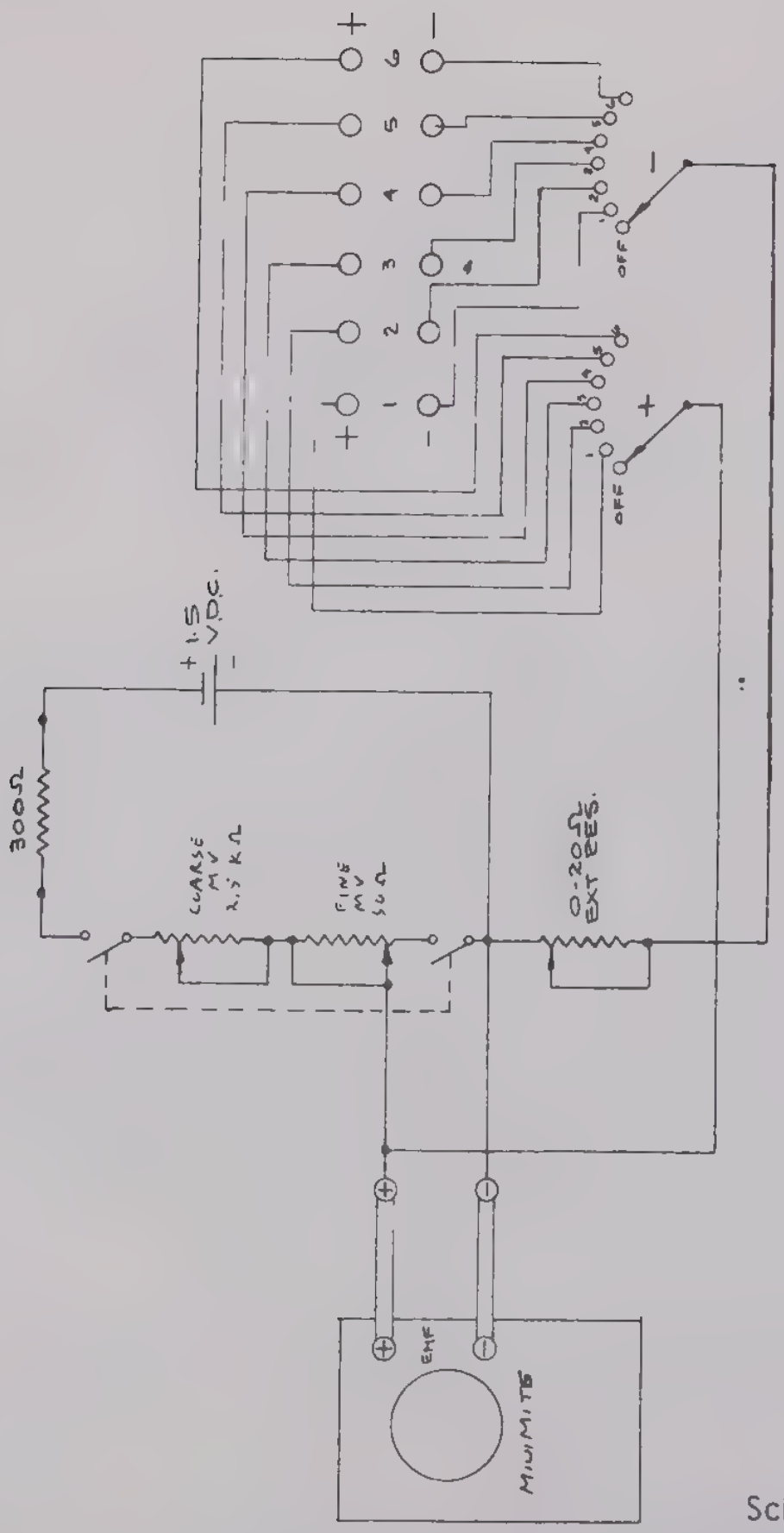


CIRCUIT CONSTANTS

CURRENT: IN R_1, R_2, R_3 = 1 MA
CURRENT: IN R_4, RJC = 1 MA @ 75°F
RESISTANCE: R_1, R_2, R_3 = 1019.3 Ω
RESISTANCE: R_4 = 1004.5 Ω
RESISTANCE: RJC = 15.0 Ω @ 75°F
RESISTANCE CRITICAL DAMPING (RCD = 200 Ω (TE Nº 7241-32)
RESISTANCE: ZERO ADJUSTERS = 1. Ω (Two 0-1.5 Ω)
RESISTANCE: SHUNTED SLIDEWIRE = 80. Ω
VOLTAGE ACROSS RJC = 15. M.V. @ 75°F

NOTE:
① R_1 = R_1 + 0.5 Ω ZERO ADJUST.
② R_2 = COMBINED RESISTANCE OF SHUNTED 80 Ω SLIDEWIRE AND R_2 RANGE CARD SPOOL.

Schematic Diagram
MiniMite with CVS
Models 31104, 31107



Schematic Diagram
MultiMite
Model 31121

8-0 ADDENDUM

8-1 Installation

The MiniMite may be supplied with a special flanged case for panel mounting. The case mounts in a 4.25" x 5.63" cutout and is secured to the panel with four screws.

If the MiniMite is to be permanently installed in a panel or used in areas where devices containing mercury are prohibited, a constant voltage supply (CVS) may be supplied in place of the standard cell and battery. A 115 Vac 50-60 Hz connection is required. MiniMite Model 31104 is portable and has a side mounted CVS. Model 31107 has a rear mounted CVS and EMF terminals.

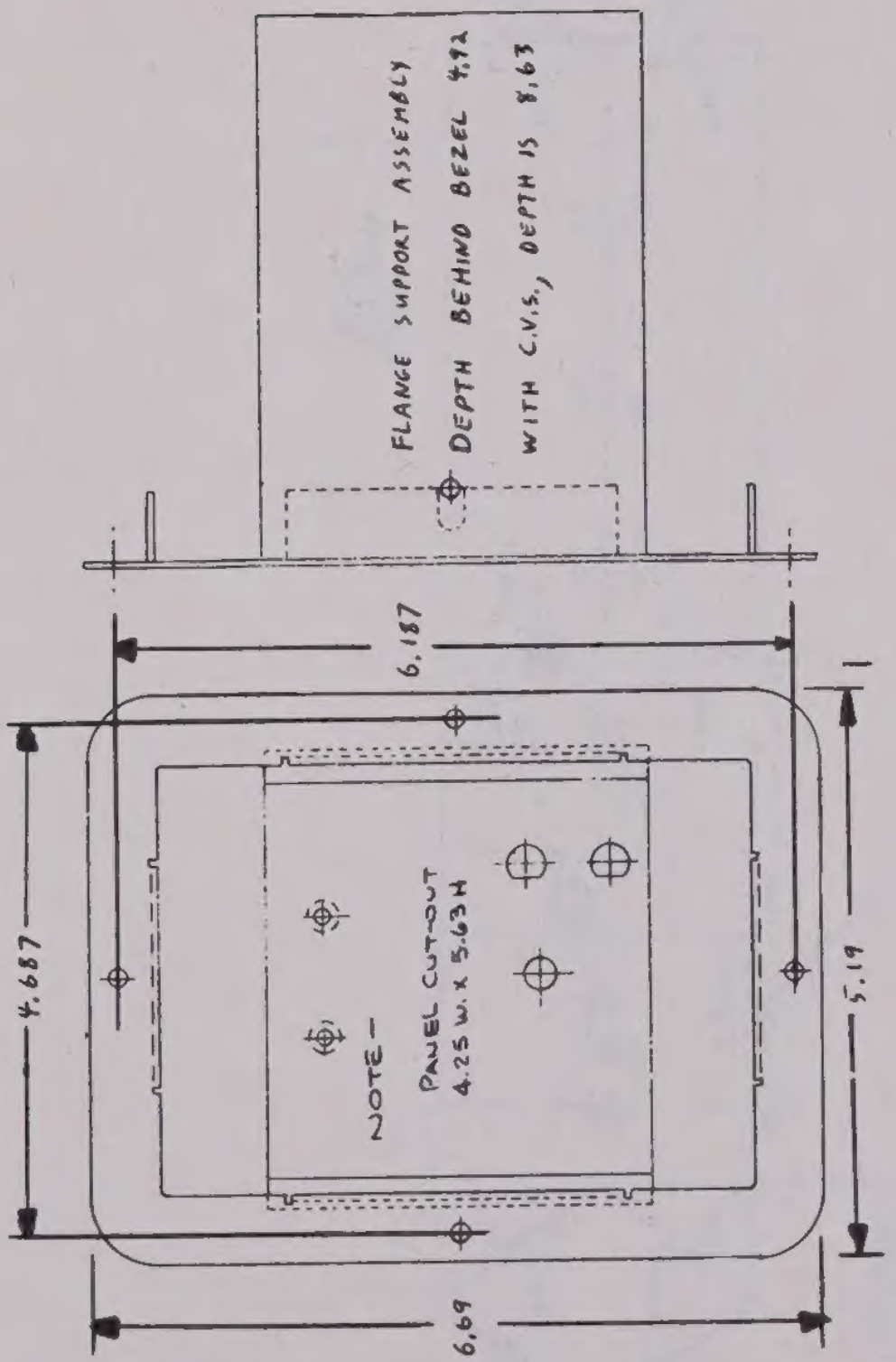
8-2 Constant Voltage Supply (Models 31101 and 31107 only)

The Constant Voltage Supply provides a constant 1.5 VDC to the measuring circuit regardless of voltage fluctuations in the incoming AC line. AC line voltage is applied to the stepdown transformer and rectified by the full wave diode bridge circuit. Capacitor C_1 and the resistance of the transformer's secondary combine to provide 60 cycle filtering. Regulation is accomplished in two stages. The first stage consists of Zener diode Z_1 and R_1 (current limiting resistor). Filter capacitors C_2 and C_3 suppress noise in diodes Z_1 and Z_2. The second stage regulation is accomplished by Zener diode Z_2. The Wheatstone bridge circuit (R_2, R_6, R_7, Z_2) effectively cancels the internal Zener impedance effect to provide optimum regulation. The dividing network (R_3, R_4, R_5) provides the required 2.0 MA output across the measuring circuit. Resistor R_5 is externally adjustable and provides the means for adjusting the output to the specified accuracy. See Constant Voltage Supply schematic.

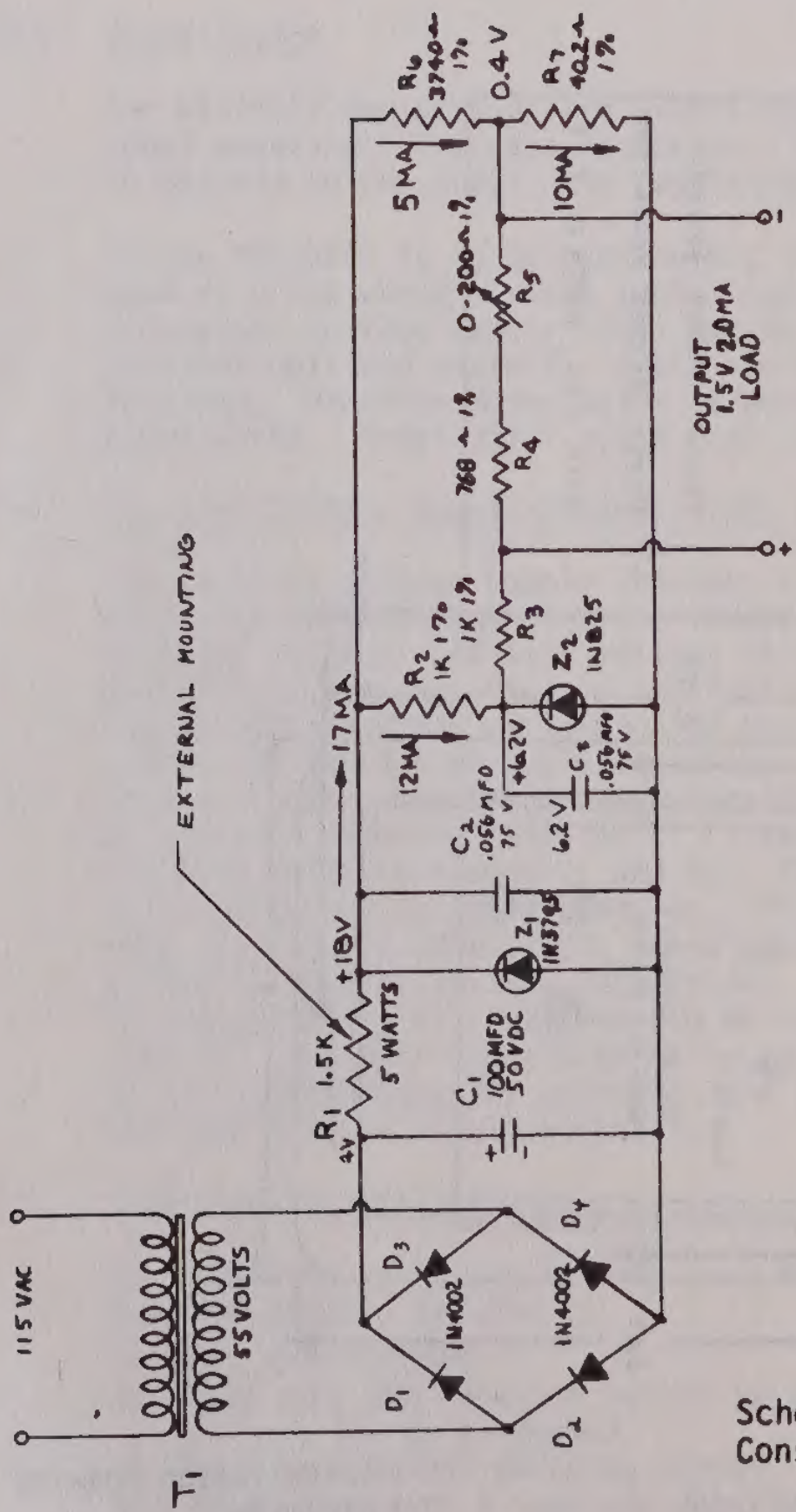
8-3 Shipping Instructions

If it becomes necessary to ship your MiniMite back to the factory for repair, be sure to:

1. Remove batteries
2. Make sure the function switch is in lock position to protect the galvanometer
3. Pack in original shipping carton
4. Ship along with a complete description of the problem, plus any corrective measure you attempted.



Installation Drawing
MiniMite



Schematic Diagram
Constant Voltage Supply

Thermo Electric Co., Inc.
107 5th. St.
Saddle Brook
N.J. 07662

or - 201- 843-5800

www.manualsplus.com
1027527

THERMO ELECTRIC
Saddle Brook, New Jersey 07662
Brampton, Ontario L6W 3J2
Leiden, Box 515, The Netherlands